3_is: New Tools for Sharing Knowledge

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Abstract. We present a system designed for supporting e-lectures. The concepts inspiring the design process were dialogical knowledge construction and situated editing of contents. The design methodology rested on an inter-disciplinary approach and was based on a co-evolutionary process where concept design, technology design and activity design were carried out in parallel so that each strand of the process could inform the others. The 3_is system consists of a presence environment, the physical classroom in which the lectures take place, and a remote environment, the Web platform, both managed by a modular architecture. The whole system will be available as General Public Licence.

Keywords. Dialogical knowledge, Situated editing, Peer learning, Co-evolutionary design process.

1. Introduction

We describe a project on learning and teaching devoted to design educational artefacts for supporting e-lectures. The concepts inspiring the design process were dialogical knowledge construction (DKC) and situated editing (SE) of contents.

The dialogical knowledge construction support teacher/student and student/student interaction facilitating the processes of exemplifying concepts, negotiating meaning, and sharing content.

The situated editing of content enables real time manipulation of educational assets. Students and teacher can re-organise and produce contents in order to create their own version of the lecture. The Rationale for these design concepts is the following: today the emphasis on learning technologies and practices has shifted towards: I) students achieving personal understanding of new information rather than simply being able to recall it on demand, and II) co-construction rather than transmission as the means by which this understanding is achieved. However, there are two fundamental drawbacks in educational practices that instead of being overcome by ICT technologies are amplified by them.

I. Most of the educational approaches and associated ICT still assume a world of independent individuals who "acquire" knowledge according to universal principles, tempered only by individual differences in aptitudes and abilities. But, the reality of classrooms and other learning groups is very different from this simplistic account. More salient than what is universal in human learning and development is the diversity that characterizes any class, school or group of learners, particularly as age increases. Not only do students/professionals differ in gender and ethnic and social background, in the language that they speak at home, and in their current levels of performance on educational tasks, they also differ in espoused values, aspirations, interests, and experiences outside the learning environment. Learning theories and tools that fail to take this diversity into account provide little help for teachers who, themselves, differ in similar ways (Wells, 1999).

The DKC design concepts aims to provide the same educational dignity to teacher-student relationship as well as to peer to peer relationship.

II. The co-construction of knowledge in the learning process is relegated to pre-established paths that follow the abstraction-instantiation loop. Most of our teaching is done through abstraction. Mostly we study a topic until we think we understand it, we abstract the general principles, and then we teach these general principles to students, usually through lectures. Afterwards, students learn the principles by trying to translate them to some practical reality, to some concrete lessons in their own head, and then they struggle to put sense to this and to form their own abstractions. Things do not change a lot if you start with practical examples.

The pervasiveness of this educational practice makes “natural” that the production of educational assets (i.e. slides, textbooks, case study, exercises) is done by one side of the educational process, the teacher. Only the teacher has the abstract knowledge and thus can start the production of educational asset. The students are completely out from the possibility to produce institutionalised educational assets, but then the theory goes that proper understanding is achieved only by co-construction of knowledge (Fusai et al., 2003).

The SE design concept aims to an environment (physical and conceptual) where the production of educational assets can be co-produced by the teachers and the students.

Summarizing, the project aims to design of artefacts for enabling the construction of dialogical knowledge (i.e. educational assets co-produced by professors and students) and the capture, organization and manipulation of contents provided in the lecture in real time. In the following we first will first present on outline of the design approach with a focus of the specific condition of the design process, then will describe the main results of the design process so far produces

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(i.e. the tools and their main functions), and will end with the future directions we are ready to address.

2. Method

The design methodology rested on an inter-disciplinary approach that encouraged intersections between scientists, professionals, final users; and at the same time between design disciplines and basic research. This allows us to borrow from each area practices, methods and experience for the definition of possible solutions. The design rested upon a co-evolutionary process, where concept design, technology design and activity design were carried out in parallel so that each strand of the process could inform the others (Rizzo et al., 2003). The process was articulated in two main phases: divergence and convergence. Divergence included inspiration to get insights from the application domain (user and educational practices) and elaboration to develop concepts from the perspective of single disciplines (architecture, interaction design, visual design, human factors). Convergence includes a phase of sharing to present and confront concepts elaborated separately during the divergence phase (concept testing) and production to evolve single concepts in integrated "concept scenarios" (scenario testing and briefing). The process was co-evolutionary since it allowed sub-processes (user understanding, briefing, concept testing) to evolve in parallel and to converge for sharing, refining and developing integrated concept/activity scenarios. An interesting aspect was that the design process was carried out on top on real/official running educational activities: four classes of the Faculty of Literature and Philosophy of Siena University were involved in the project: Contemporary History, Classic Philology, Educational Technology and Multimedia design. Due to this peculiar design situation along the process two issues turned out to be at the same time effective and problematic:

2.1. Parallel mock-up of role and look & feel

Following the co-evolutionary principle we started mock-upping as soon as the tool-concept was ready and we produced parallel mock-ups of both Role and Look & Feel, without worrying about prototyping the same concept or requirement more times - The more mock-ups you have of different aspect the easier it will be to find a sensible mapping between activity model and concept. This was effective since working on possible solutions is better than working on problems. But it turned out also problematic both for professors and students since in some cases they were not always ready to appreciate the explorative (probing) role these mock-ups could have for their main activity.

2.2. Mock-up-testing sessions involving the whole design team

We did not worry about formal testing until very advanced version of the prototypes, instead we carried out constant "quick and dirty" testing sessions and we did them directly in the field with the whole design team. We kept the sessions very informal since what was really important was the feeling we perceived while the activity was carried out by the users and/or by the designers. This way to join the testing sessions was were effective since it provided first-hand experience on the way the mock-ups and prototypes could affect the user activity extending on the fly the range of impact of the proposed concepts. But in some cases Professors and Students perceived it as a continuous shift from problems already identified.

3. The Concepts

We developed a collaborative educational work environment made up by different concepts, mock-ups and prototypes focused on the two main concepts: the dialogical construction of knowledge (DKC) and situated editing (SE) of contents.

According with the dialogical construction of knowledge, we designed and implemented concepts and prototypes addressed to facilitate the teacher/student and student/student dialogical interaction such as dynamic configuration of the class, post-it notice board, lecture educational format and *Marzullo* concept in which student or group of students have to create a question, answer to it and then share it with other students or groups of students.

Regarding the situated editing the lectures are audio and video recorded and matched in a timeline. The resources provided during the lecture, as documents, slides and web site, are automatically stored in a database and associated to the lecture timeline. This application allows a simple visualization and manipulation of data according to the format of resource and the time of storage. The student accessing to the lecture record can recover all the resources provided during the lecture and also other contents associated to the presented topics. At the same time recovering the topics it is possible to retrieve the lecture in which they were presented.

The resource are, also, collected and presented on a web platform that supports each class in the sharing and the manipulation of contents and documents. The platform offers many other services such as quiz, assignment and forum that stimulate the dialogical discussion out of the lecture.

These concepts are implemented into several prototypes that are continuously evaluated and refined.

4. The Prototypes

3_is consists of a presence environment, the physical classroom in which the lectures take place, and a remote environment, the Web platform, both managed by a modular architecture.

The system architecture, Figure 1, is composed by two servers one for the streaming and the capture of the video, the other for the storage and the management of data. The camera and the wireless microphone in the classroom capture the lecture and stream the video in real time through the Web platform. The videos are stored in the server and can be retrieved on the demand by the client.

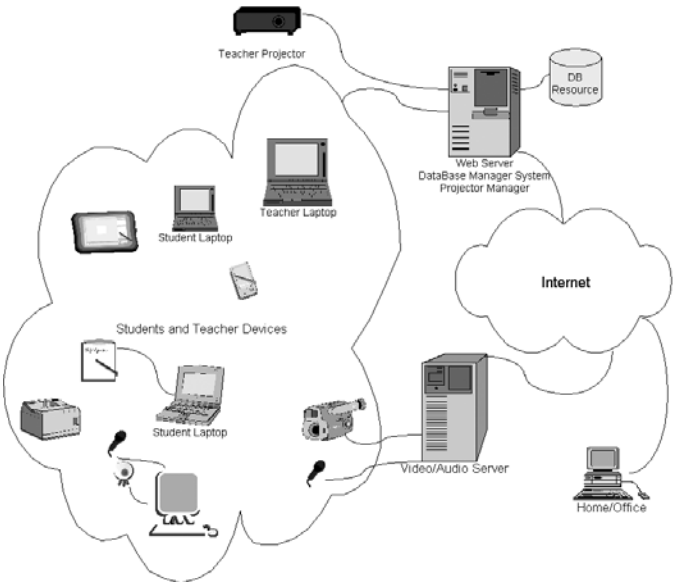

Figure 1. 3_is system architecture

Data server includes a Web Server, a DataBase Manager System (DBMS) and the projector manager. This server administers the data and contents presented and manipulated during the lecture; it allows to associate and edit dynamically the resource of the lecture and the video. The contents presented during the lesson, by teacher and student, are linked to the lecture timeline, the audio and video trace, through an algorithm that breaks the lecture flow according to the visualization of resource/content, Figure 2.

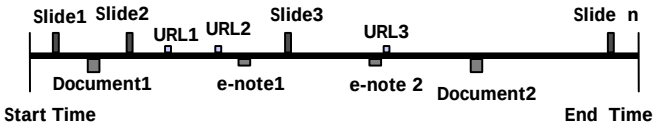

Figure 2. Lecture timeline schema

The user can easily retrieve data interacting with the lecture timeline and, vice versa, selecting the resource s/he can recover in the timeline the video associated with these data.

In the classroom the private Wireless network allows the connection of the Wireless devices, as PDA and laptop, with 3_is environment. The teacher through 3_isTeacher Application (3_isTA) can use the projector and manage student clients without cable. On the other side, the student can interact with teacher client using 3_isStudent Application (3_isSA). These applications have to be installed on the client in order to include the wireless device in the 3_is environment.

3_is Web platform (www.saul.unisi.it/3is/) includes three main parts; one module with lecture resources (textual document, presentation slides, images, movies, etc.) inserted by the teacher before or after the lesson.

This module is developed with Moodle (www.moodle.org) that is a course management system (CMS) - a software package designed to help educators create quality online courses. Such e-learning systems are sometimes also called Learning Management Systems (LMS) or Virtual Learning Environments (VLE). One of the main advantages of Moodle over other systems is a strong grounding in social constructionist pedagogy.

The second module dedicated to the data captured and manipulated during the lecture, the third module allows the dialogical interaction through dedicated tools such as forum, assignment and quiz.

At the end of the lecture 3_is applications generate automatically three different Web-based interfaces:

1. resource interface, Figure 3, contains all the resources used during the lecture,
2. audio/video interface, Figure 4, visualised the video of the lecture,
3. interactive audio/video and resources interface, Figure 5, the resources are connected to the lecture video, the user can jump from data to video and vice versa.

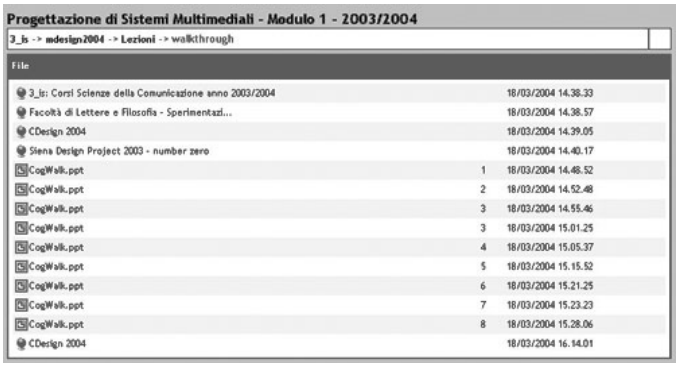

Figure 3. Resource interface

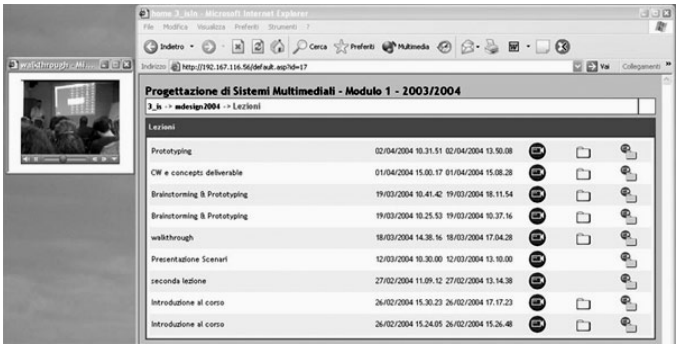

Figure 4. Audio/video interface

Figure 5. Interactive audio/video and resources interface

In the following we present a scenario to illustrate some of the 3_is feature in context.

4.1. A 3_is scenario

The teacher, before the lecture, enters the 3_is Web platform and s/he inserts the resources that s/he will present during the lecture. In the 3_is room the teacher accesses with his/her computer the Wireless LAN in order to be connected with the 3_is environment. S/he runs the 3_isTA installed on his/her computer and using the same login of Web system s/he selects the course name and inserts the topic of the lecture. Automatically the system starts the video/audio capture of the lesson and turns on the projector that shows teacher desktop. The lecture begins and the teacher shows the presentation slide and other resources that could be textual documents or web site or movie.

The 3_isTA records all the teacher actions and it allows the teacher to switch from his/her computer to a student computer and to project another computer desktop.

The students in the classroom enter 3_is environment through their laptop running 3_isSA. The application tracks their actions and allows them to post questions or reflections directly to the class community. These notes are automatically linked to the video/audio and to the slide visualised. The e-note is relevant to gather students observations, to animate the discussion during the lecture, and, at the same time, the teacher can monitor and survey students interest and doubts.

The e-notes are connected to the timeline of the lesson and visualised in the interactive resource interface.

The remote students can attend the class lecture and participate to the class discussion and exercises connecting to the 3_isLive web page of the Web platform. They can visualise simultaneously the streaming audio/video, the presentation slide and the screenshot projected in the classroom. They could participate to the lesson posting the e-note as the other students in the classroom.

During the lesson a group of three students posts an interesting e-note regarding the topic of the lecture and the teacher decides to open a forum on the Web platform in which students can discuss about it. Next week students have to present a work made in group that has to be published on the assignment module of the Web environment.

The student groups upload the assignment on the Web and wait for the teacher review. The application of the DKC and SE led the teacher to reschedule the educational format.

The students work in group with the task to perform a project in order to apply the contents proposed during the lecture. Every two weeks they have to upload on the Web the assignment that can be visualized and shared with the other groups of the class.

Next lecture, the teacher explains the techniques for conducting a creativity brainstorming session; this topic is especially relevant for the students since they have to apply them in order to perform their work. Some of the students ask more explanation about the application of these techniques. The teacher tries to make some examples but they are not enough for the students who have however some doubts. The professor starts to exemplify the methods using the topic hold by a students group. The entire class participates at the brainstorming session and at the end of the lecture they add the new contents asset to the teacher resource.

5. Conclusion

The heuristic of the two main concepts was instrumental not only for the design of the physical tools but further, it had implications for other issues such as the organization of the class and the temporal flow during lectures.

The experimentation reveals the existence of several ontologies used by teacher, student and group of students, in the organization of contents. The ontologies can be represented by semantic web architecture in which contents are connected and related. The semantic structure can be improved enabling the association of physical objects. Student notes, papers and books can be tagged using RF-id (Radio Frequency Identification) technology and with RDF (Resource description framework) technology can be semantically connected with digital document.

In the next future we plan to distribute 3_is telematics architecture and applications with General Public License (GPL), it could be downloaded www.saul.unisi.it/3is/.

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